National Estuarine Research Reserve System

Kachemak Bay Research Reserve

Kachemak Bay Salt Marshes

Interactions between land elevation and sea level

Why Salt Marshes?

- **Highly productive habitats**
- **Plants that can tolerate salinity and flooding**
- **Used by a wide range of animal species**
  - **Insects and other invertebrates, fish, shorebirds, waterfowl, variety of mammals**

Why Salt Marshes?

- **Highly sensitive to changes in relative sea level**

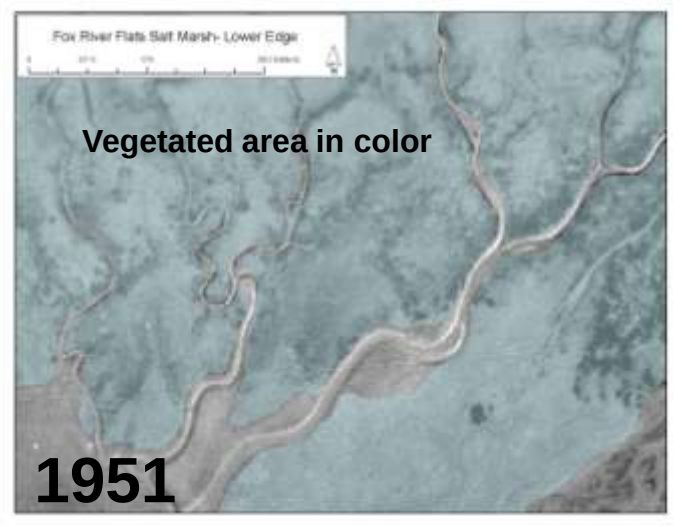
Large areas affected by small changes in water level.

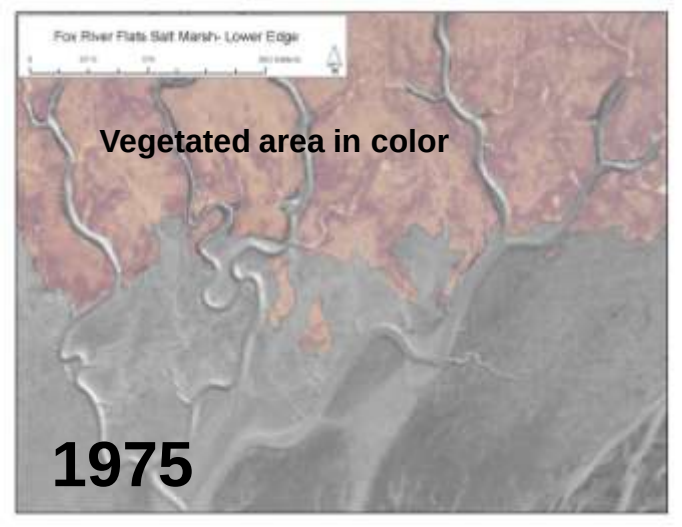
Plant distributions driven by minor changes in elevation.

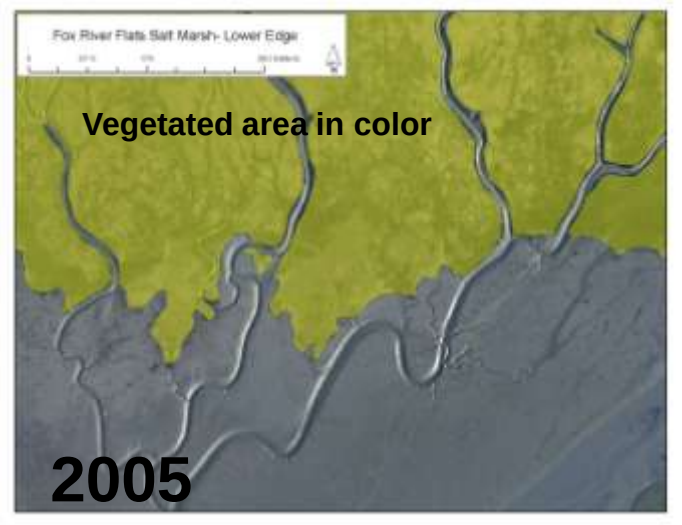
Why Salt Marshes?

- **Surface-level elevation changes affected by a wide range of factors**
- **May differ from surrounding uplands**
  - **Underlying ground movement**
  - **Sediment accretion**
  - **Erosion**
  - **Compaction**

Migration of Marsh Habitats in Response to Relative Sea-Level Change





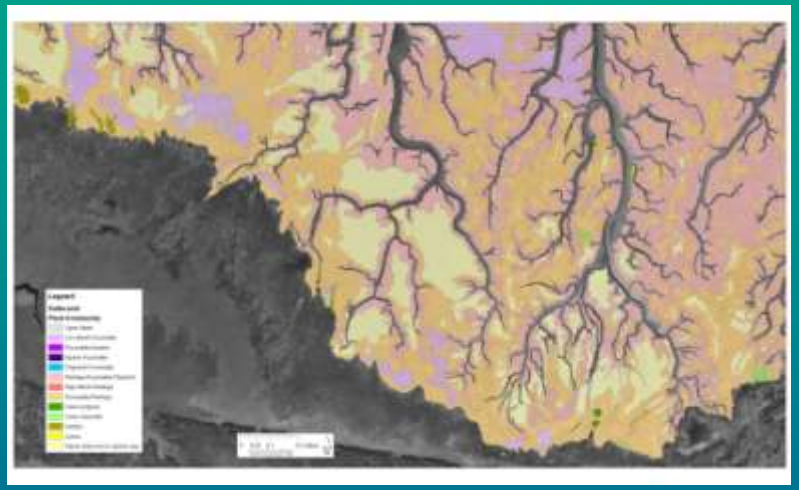


At lower edge of marsh, vegetation line moved back toward uplands. Many acres of vegetated marsh converted to mud flats.

At upper edge of marsh, spruce and shrubs retreated following the quake, and are slowly moving back out into marsh.

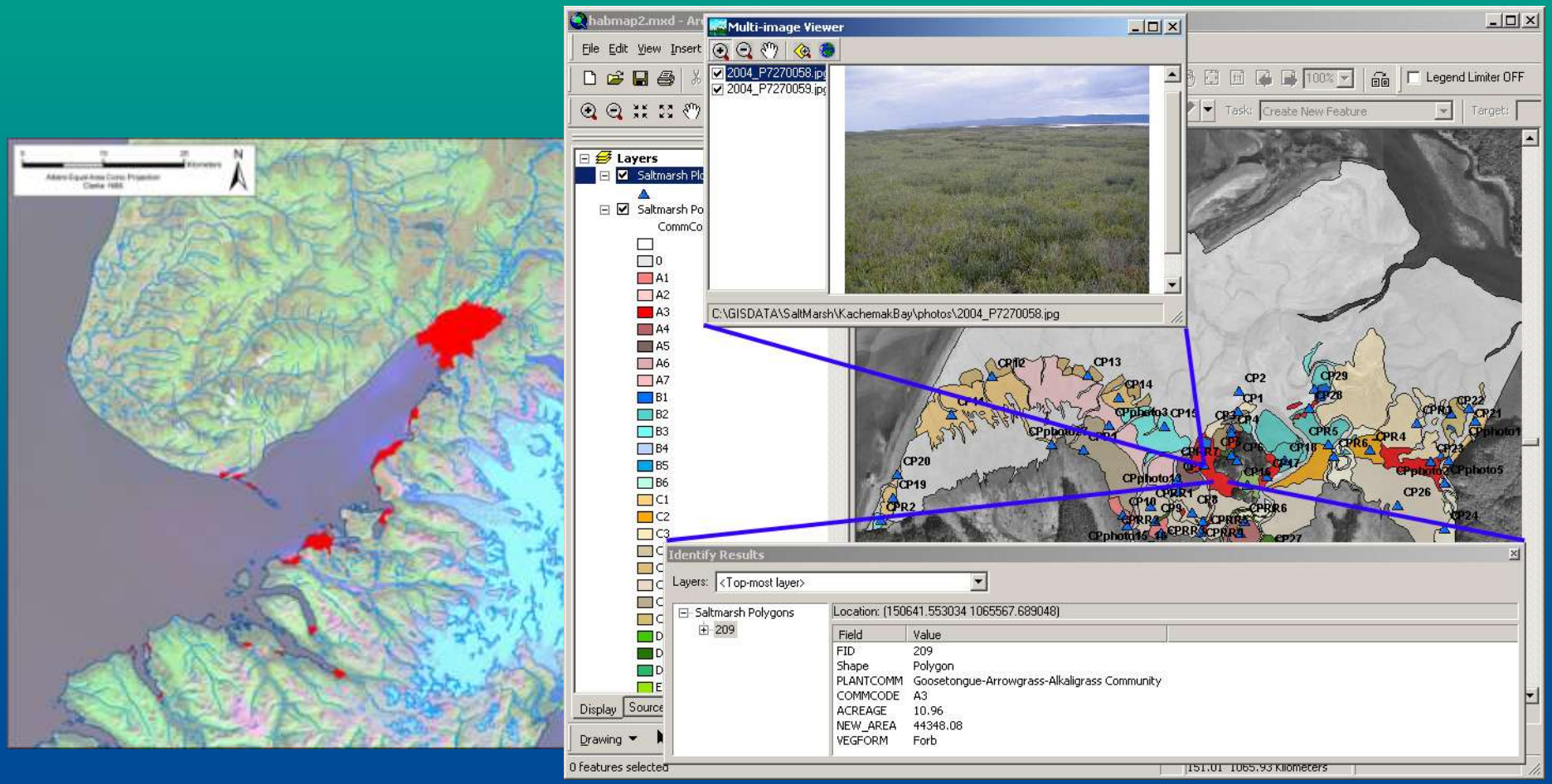
Building on previous work

- **Salt marsh mapping**
- **Juvenile salmon studies**
- **Biomonitoring**



Salt Marsh Mapping 2003-2004

- **Initial mapping part of project to map all intertidal habitats of Kachemak Bay**
- **Methods based on Tande 1996 (Lake Clark NP)**



Salt Marsh Mapping 2003-2004

- **Diversity of salt marshes in Kachemak Bay**

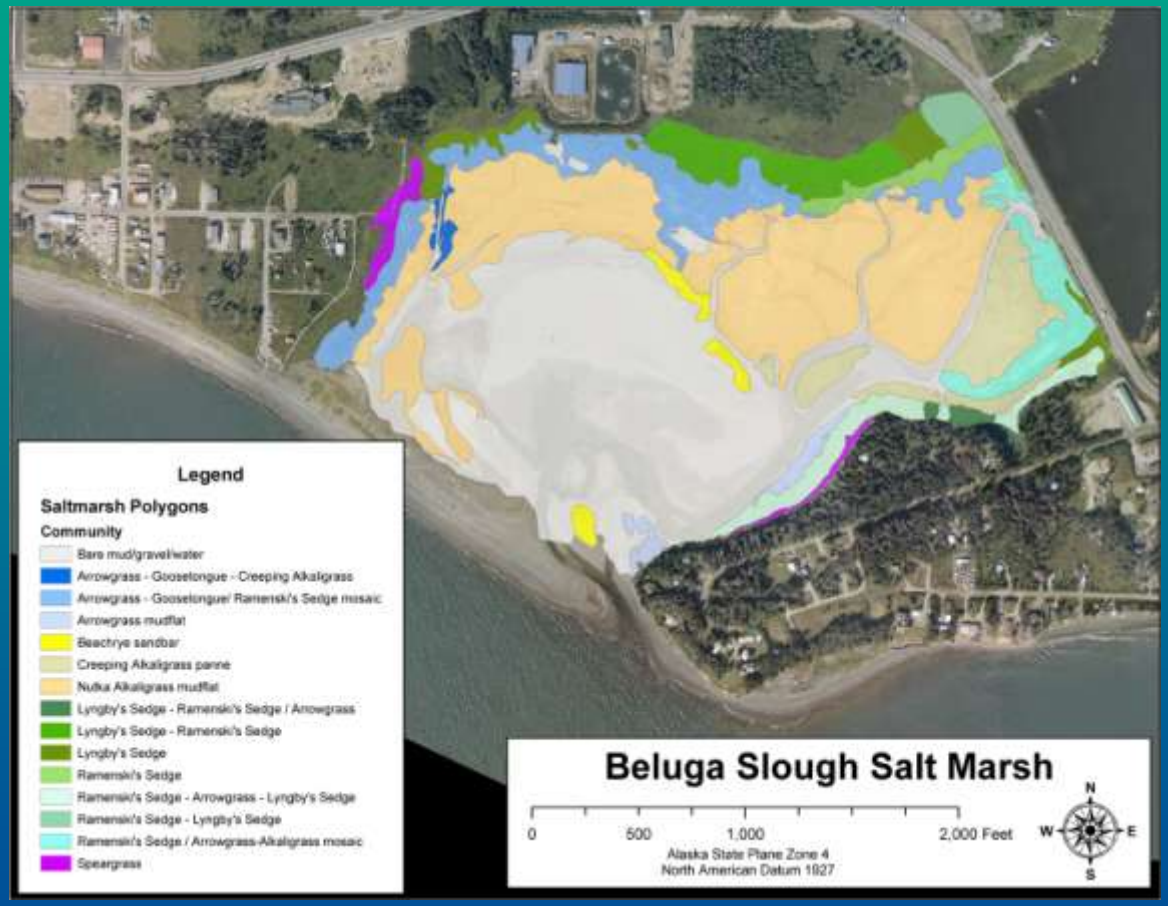
From bare mud, to sparsely vegetated gravel, to lush sedges

Salt Marsh Mapping 2003-2004

- **Diversity of salt marshes in Kachemak Bay**

From remote pristine sites, to urban marshes, to heavily impacted sites.

Salt Marsh Mapping 2003-2004



Mapping is good for detecting large-scale changes over long time periods; not sufficient for detecting more subtle changes.

Fox River Flats Salmon*

Juvenile salmon use a variety of habitats in FRF, all summer long

* Coowe Walker, Tammy Neher

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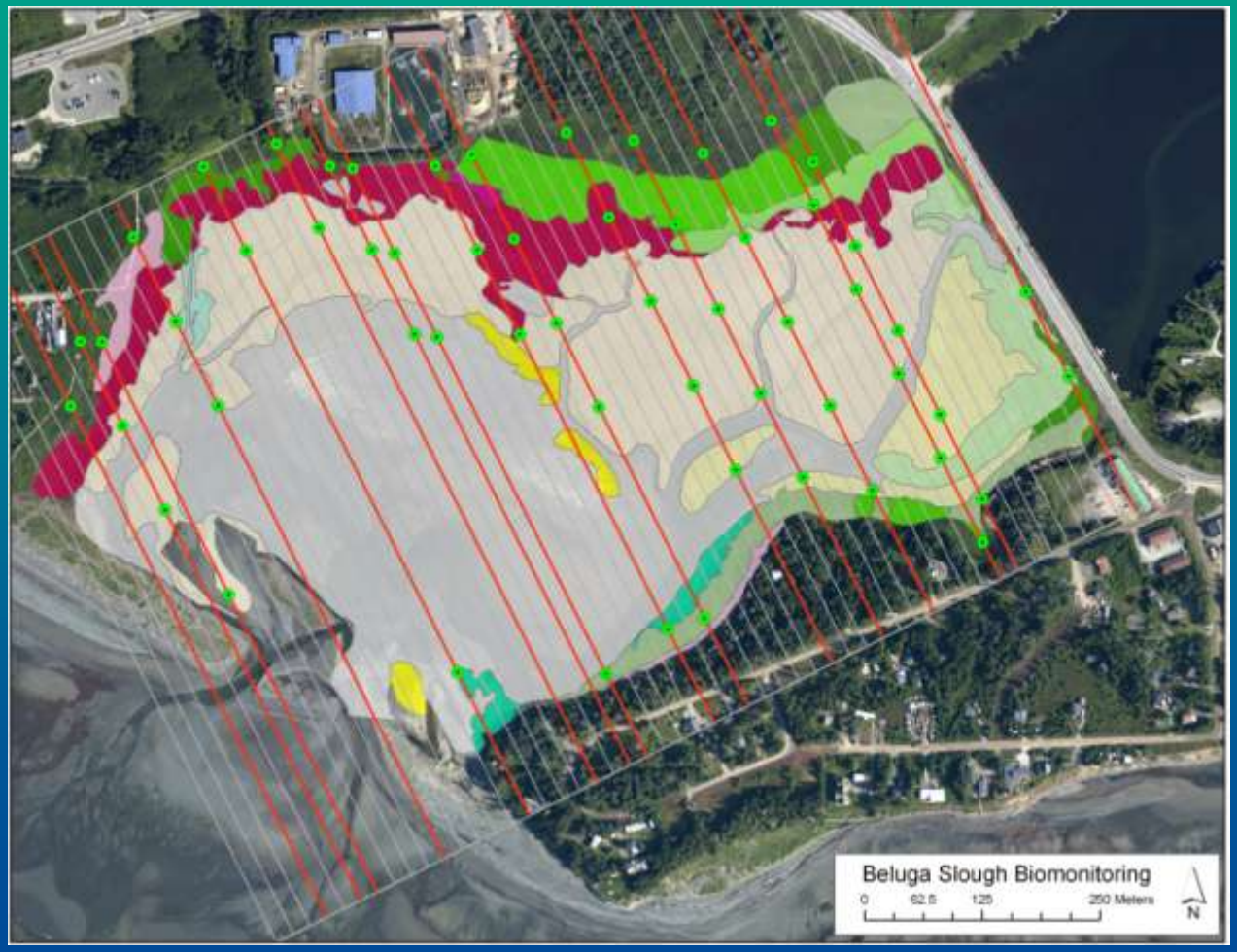
Fox River Flats Salmon

NERRS SWMP Biomonitoring



- Permanent plots
- Transects and plots located randomly
- Plots marked with wooden stakes, rebar
- Plant species percent cover, stem heights and density
- Photos and GPS locations

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NERRS SWMP Biomonitoring

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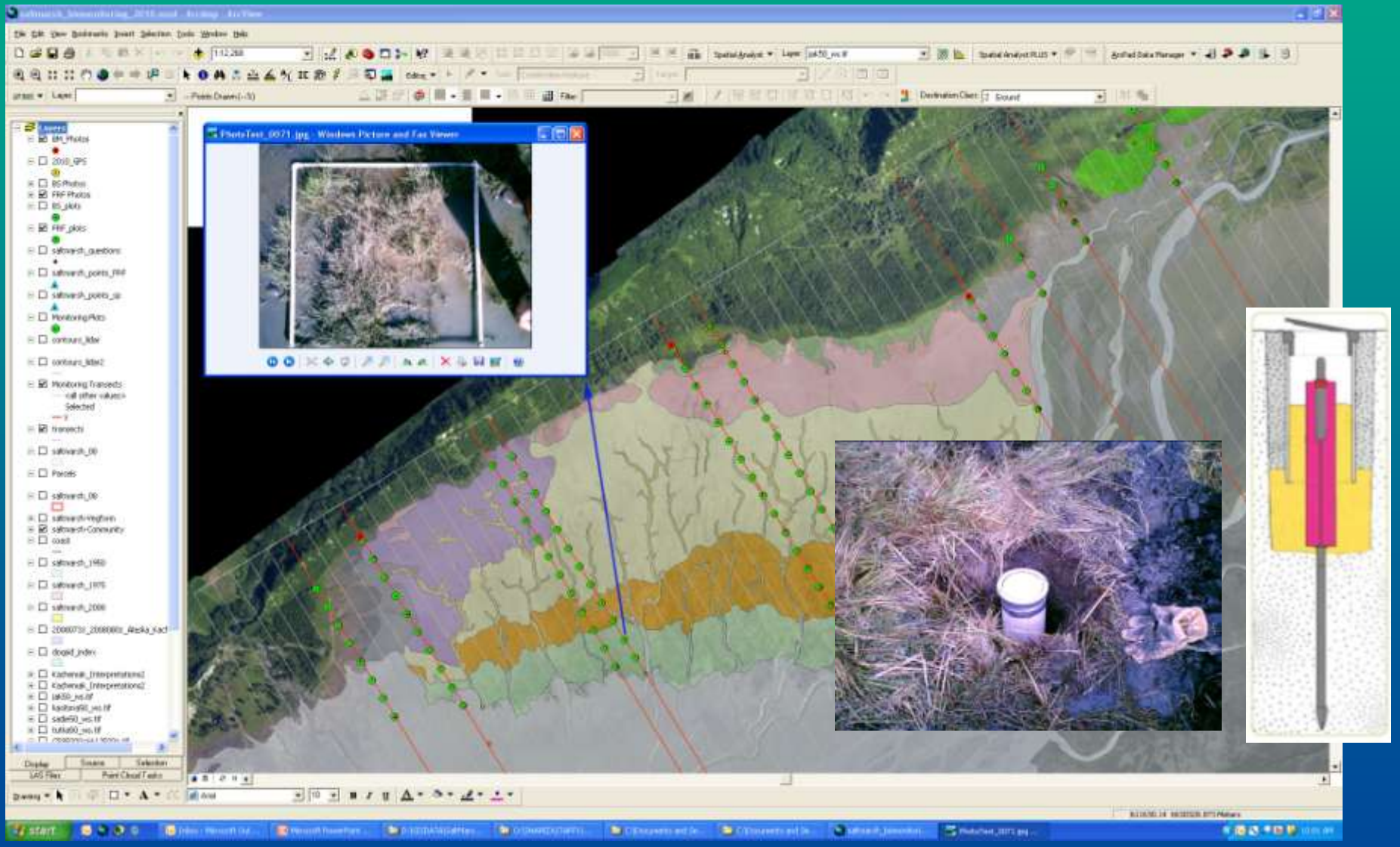
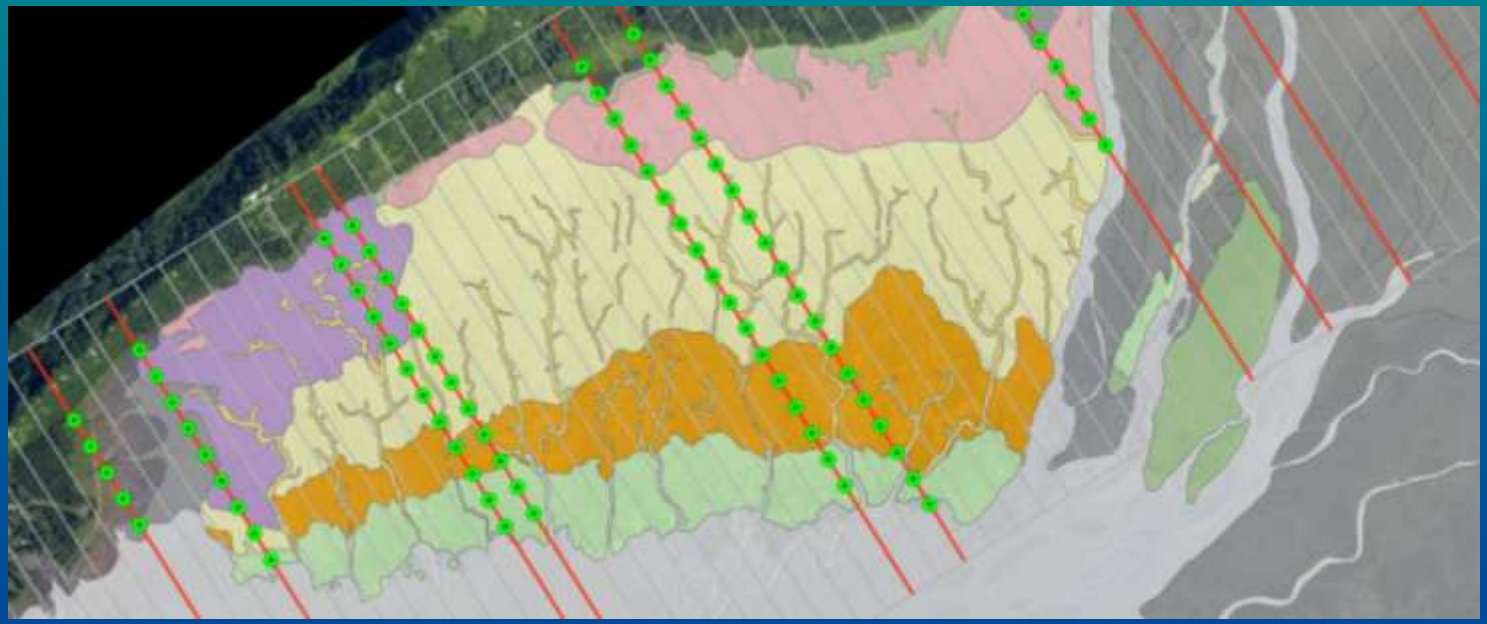
NERRS SWMP Biomonitoring



Science Collaborative

- **Establish vertical control in four salt marshes**
- **Assess changes in vegetation**
- **Assess sedimentation rates, accretion, erosion**
- **Measure salinity, temperature, inundation**



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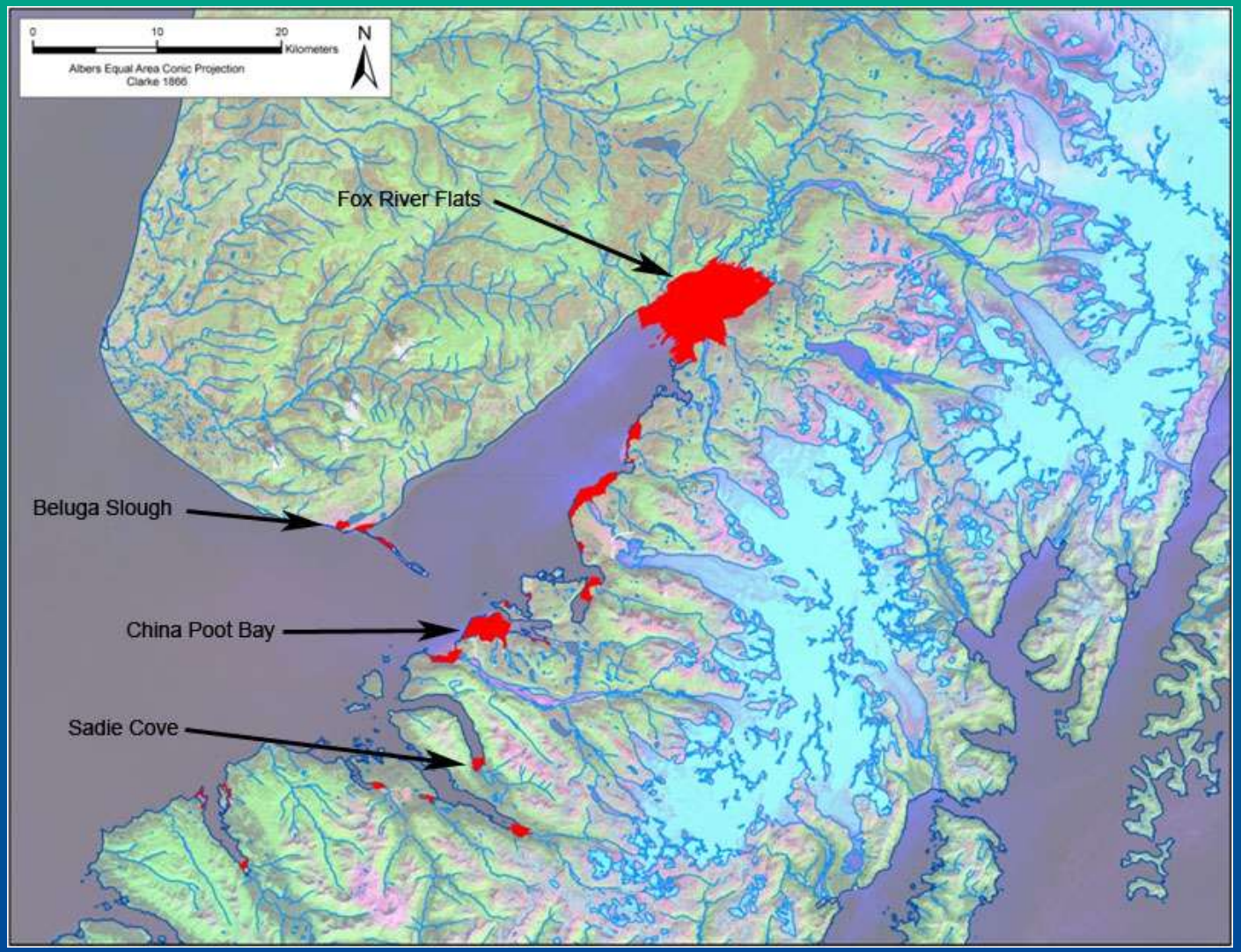
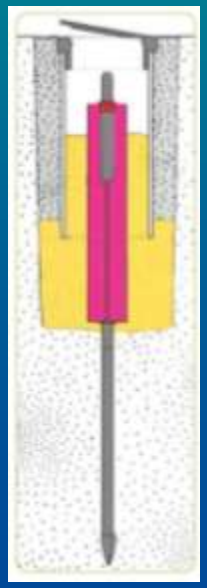
Science Collaborative



Science Collaborative

Vertical Control

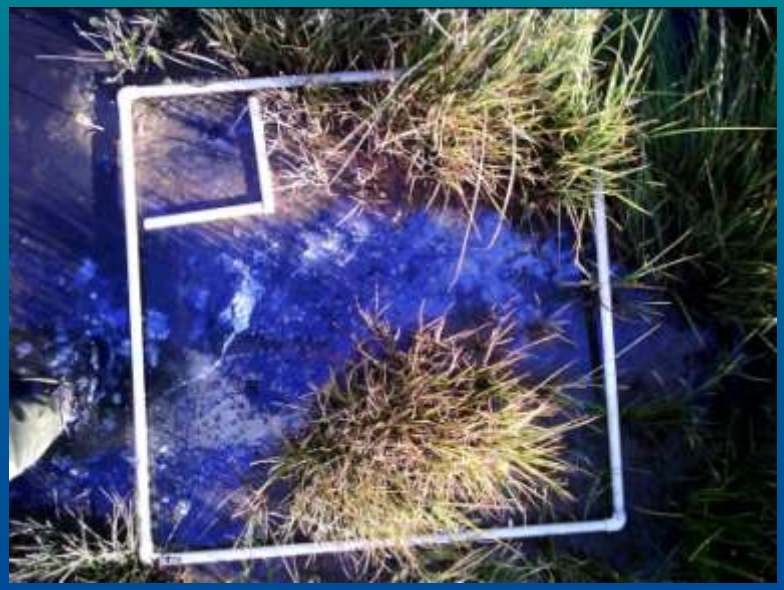
- Install 3 monuments at upper edge of each marsh
- Possibly 1 or 2 monuments mid-marsh
- Measure these with high-precision GPS at least annually



Science Collaborative

Assess Vegetation Changes

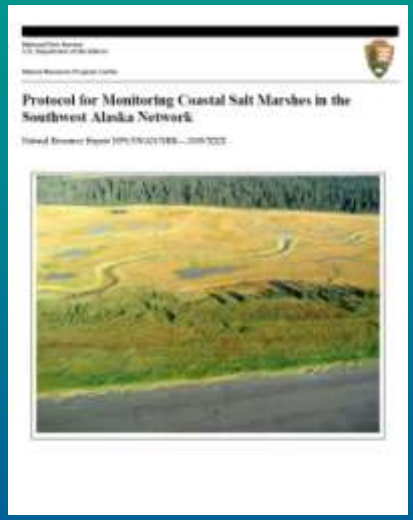
- Establish 50 – 100 permanent vegetation plots per marsh
- Monitor these for changes in % cover, species composition



Science Collaborative

Assess sedimentation, accretion, erosion

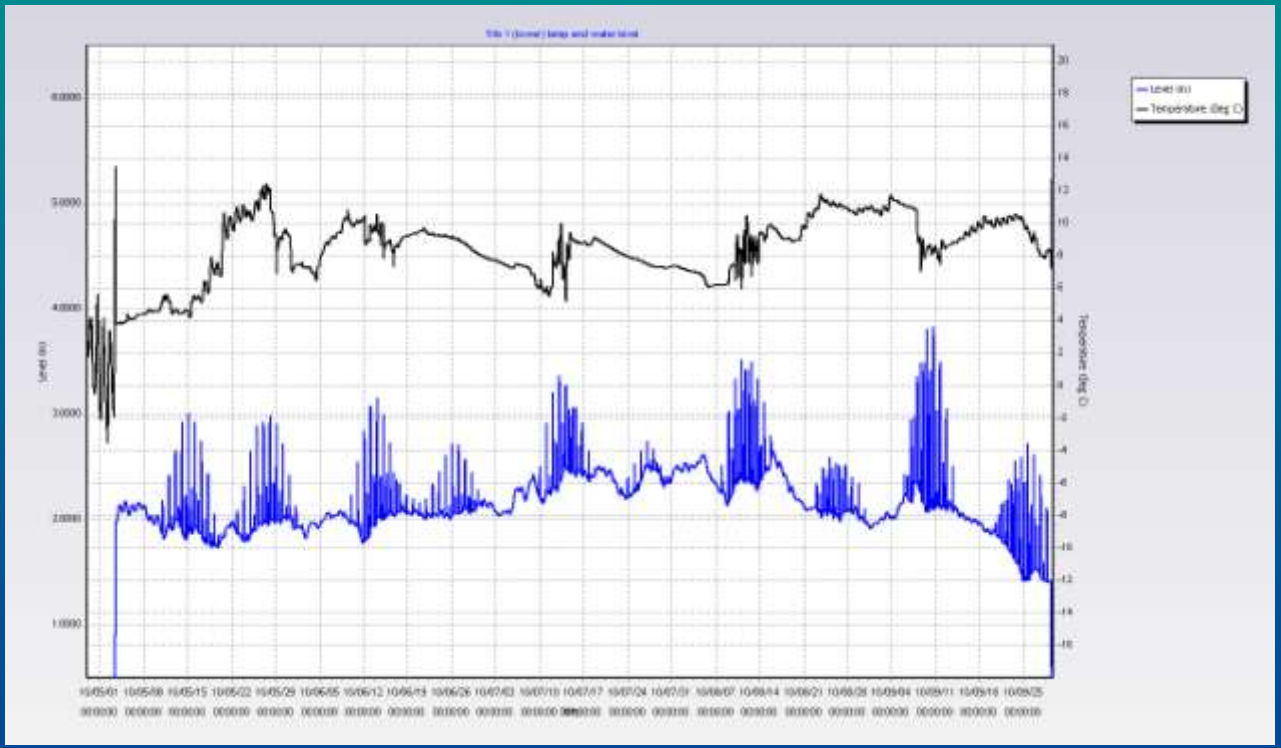
- **SWAN (NPS) Protocol (Jorgensen 2009)**
  - **Topographic profiles with digital level**
  - **For finer-scale measurements:**
    - **SET?**
    - **Marker horizons?**


Protocol for Monitoring Coastal Salt Marshes in the Southwest Alaska Network

Science Collaborative

Physical Parameters

- Soil temperature, water level, salinity
  - Temp and water level measured with loggers
  - Salinity?



Summary

- **Salt marshes are ecologically important**
- **Sensitive to small changes in RSL**
- **If marsh surface rises,**

  plants should shift seaward
- **Understand balance between uplift,**

  erosion, sedimentation/accretion